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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/630,658	07/31/2003	Thomas A. Taylor	CS-21320	9490

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PRAXAIR, INC.  
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EXAMINER
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BAREFORD, KATHERINE A

ART UNIT	PAPER NUMBER
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1762

DATE MAILED: 06/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/630,658

Applicant(s)

TAYLOR, THOMAS A.

Examiner

Katherine A. Bareford

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 02 June 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) 14-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13,21,22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

1. The amendment filed June 2, 2006 has been received and entered. With the amendment, claims 14-20 remain withdrawn from consideration, and claims 1-13 and 21-22 remain pending for examination.

#### *Claim Rejections - 35 USC § 112*

2. The rejection of claim 21 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention is withdrawn due to applicant's amendment of June 2, 2006 to clarify the claim.

#### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-13 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zurecki et al (US 5738281) in view of Nowotarski et al (US 5486383) and the admitted state of the prior art.

Zurecki teaches a method of placing a gas shroud around a turbulent gas jet. Column 1, lines 5-15. This method can be used in spraying applications, such as thermal spray coating. Column 4, lines 15-25. A jet exits from an orifice of the thermal spray device and is surrounded with a coaxial gas shield having a shield gas flow substantially surrounding the effluent of the thermal spray device. Column 3, lines 1-25. By using an inert surrounding gas, when thermal spraying, the amount of oxygen aspirated into the jet is reduced, thus minimizing the oxidation of the sprayed coating material and providing a desired microstructure of a coating with minimized oxidation of the coating material as supplied. Column 4, lines 15-25. As shown by Example 3, oxygen concentration in the spray jets of shrouded spray devices of Zurecki can be well over 50% less than for unshrouded jets at the same standoff distance (3 inches). Column 9, lines 45-55 and column 11, lines 10-60, note, for example, in run no. 2, for example, with no shroud gas flow, the first or 0 flow rate, oxygen conc. is 14.0, going down to 2.1 as the flow rate of the shroud gas is increased (Table 2).

Claim 3: As shown by Example 3, oxygen concentration in the spray jets of shrouded spray devices of Zurecki can be well over 50% less than for unshrouded jets at the same standoff distance (3 inches). Column 9, lines 45-55 and column 11, lines 10-60, note, for example, in run no. 2, for example, with no shroud gas flow, the first or 0 flow rate, oxygen conc. is 14.0, going down to 2.1 as the flow rate of the shroud gas is increased (Table 2).

Claim 4, 5: the gas flow can be essentially turbulent. Column 3, lines 5-30 (the spray effluent from the spray device is turbulent, and the shroud gas is entrained in that flow).

Claim 9: the shield (shroud) gas can be nitrogen. See column 11, lines 10-60.

Zurecki teaches all the features of these claims except (1) that the resulting effect on microstructure will allow an extended standoff distance for the same microstructure, (2) that the material to be sprayed is a ceramic oxide (claim 2, 6, 11, 21) which would be not sensitive to oxidation or nitridation (claim 1), (3) that the shield gas is argon (claim 10) (4) that the ceramic oxide is zirconia (claims 7, 12), (5) that the multiple layers of coating material are provided (claims 8, 13), (6) that the substrate has a complex shape such as turbine blades or vanes (claims 1, 22) and (7) the specific gas temperature results of using the shroud (claim 1).

However, Nowotarski teaches that when thermal spraying a turbulent fluid stream is ejected from a spray nozzle. Column 3, lines 20-60. The stream can carry coating material which can be metals, alloys, oxides, ceramics, and other materials. Column 3, lines 20-65. Nowotarski teaches the desire to surround the stream with a shielding gas flow of an inert gas such as nitrogen, argon, etc. See column 3, line 60 through column 4, line 40. The use of this shielding gas prevents oxygen from entering the spray stream so that oxidation or contamination or degradation of materials is minimized. Column 4, lines 20-35. The amount of shielding fluid used is such that the oxygen level at the point of impact can be less than 1%. Column 4, lines 25-35.

Nowotarski teaches that by reducing the oxygen level, the standoff distance can be increased. Column 7, lines 35-55.

The admitted state of the prior art, at pages 4-5, teaches that it is well known to apply ceramic coatings by thermal spraying. These ceramic coatings can include thermal barrier coatings. The thermal barrier coatings are often multilayer coatings with a metallic bond coat followed by a ceramic top coat. The ceramic top coat is usually based on zirconium oxide (zirconia). The metallic bond coat can also be applied by thermal spraying. The admitted state of the art further teaches that it is well known to apply these thermal spray coatings to complex shapes such as turbine vanes.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Zurecki to increase the standoff distance for the same microstructure as suggested by Nowotarski in order to provide a desirable coating, because Zurecki teaches that the use of the coaxial shielding gas provides a decreased oxygen level in the spray stream for a given distance, thus reducing oxidation of the applied coating (that is, providing a desired microstructure of limited further oxidation) and Nowotarski teaches that the use of shielding gas that provides a decreased oxygen level in the spray stream for a given distance can allow an increased standoff distance, and that the shielding gas can be used to reduce oxidation, contamination or degradation of the material (again providing a desired microstructure). This provides a longer standoff distance to get the same microstructure as without shielding, because the resulting microstructure provided by the presence of a first amount of oxygen will

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not occur until a longer standoff distance when shielding is used since that first amount of oxygen will be present in the stream a much greater distance (more than 50 % as shown by Zurecki) from the nozzle. It would further have been obvious to modify Zurecki to perform the spraying with ceramic oxides, which would be materials not sensitive to oxidation or nitridation, as taught by Nowotarski with an expectation of desirable coating results, because Nowotarski teaches the desire to shield coatings of ceramics and oxides as well as metals, as the shield also prevents contamination. It would further have been obvious to modify Zurecki to perform the shielding with argon as taught by Nowotarski with an expectation of desirable coating results, because Zurecki teaches the desire to shield with an inert gas, such as nitrogen, and Nowotarski teaches the desire to shield coating sprays with inert gases, which can include argon as well as nitrogen. It would further have been obvious to modify Zurecki in view of Nowotarski to apply a zirconia coating and to apply a multilayer coating such as a thermal barrier coating of metallic bond coat followed by ceramic top coat and to apply the coating to a complex shape such as a turbine vane/blade as suggested by the admitted state of the prior art with an expectation of providing a desirable coating, because Zurecki in view of Nowotarski teaches a gas shielding system for thermal spraying that can be used with metals or ceramic oxides and the admitted state of the prior art teaches that when thermal spraying a desirable coating system to apply is metal bond coats followed by zirconia top coats to a complex shaped substrate such as a turbine vane/blade. As to the specific gas temperature results of using the shroud, it is

the Examiner's position that such temperature results would naturally occur with the use of the process of Zurecki in view of Nowotarski and the admitted state of the prior art as described above, because it is the suggested use of the shroud that provides these gas temperature results, and the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

5. Claims 1-13 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zurecki et al (US 5738281) in view of Nowotarski et al (US 5486383) and Taylor, et al "Experience with M Cr Al and thermal barrier coatings produced via inert gas shrouded plasma deposition" (hereinafter Taylor article).

Zurecki teaches a method of placing a gas shroud around a turbulent gas jet. Column 1, lines 5-15. This method can be used in spraying applications, such as thermal spray coating. Column 4, lines 15-25. A jet exits from an orifice of the thermal spray device and is surrounded with a coaxial gas shield having a shield gas flow substantially surrounding the effluent of the thermal spray device. Column 3, lines 1-25. By using an inert surrounding gas, when thermal spraying, the amount of oxygen aspirated into the jet is reduced, thus minimizing the oxidation of the sprayed coating material and providing a desired microstructure of a coating with minimized oxidation



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of the coating material as supplied. Column 4, lines 15-25. As shown by Example 3, oxygen concentration in the spray jets of shrouded spray devices of Zurecki can be well over 50% less than for unshrouded jets at the same standoff distance (3 inches). Column 9, lines 45-55 and column 11, lines 10-60, note, for example, in run no. 2, for example, with no shroud gas flow, the first or 0 flow rate, oxygen conc. is 14.0, going down to 2.1 as the flow rate of the shroud gas is increased (Table 2).

Claim 3: As shown by Example 3, oxygen concentration in the spray jets of shrouded spray devices of Zurecki can be well over 50% less than for unshrouded jets at the same standoff distance (3 inches). Column 9, lines 45-55 and column 11, lines 10-60, note, for example, in run no. 2, for example, with no shroud gas flow, the first or 0 flow rate, oxygen conc. is 14.0, going down to 2.1 as the flow rate of the shroud gas is increased (Table 2).

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Claim 9: the shield (shroud) gas can be nitrogen. See column 11, lines 10-60.

Zurecki teaches all the features of these claims except (1) that the resulting effect on microstructure will allow an extended standoff distance for the same microstructure, (2) that the material to be sprayed is a ceramic oxide (claim 2, 6, 11, 21) which would be not sensitive to oxidation or nitridation (claim 1), (3) that the shield gas is argon (claim 10) (4) that the ceramic oxide is zirconia (claims 7, 12), (5) that the multiple layers of

coating material are provided (claims 8, 13), (6) that the substrate has a complex shape such as turbine blades or vanes (claims 1, 22) and (7) the gas temperature results of using the shroud (claim 1).

However, Nowotarski teaches that when thermal spraying a turbulent fluid stream is ejected from a spray nozzle. Column 3, lines 20-60. The stream can carry coating material which can be metals, alloys, oxides, ceramics, and other materials. Column 3, lines 20-65. Nowotarski teaches the desire to surround the stream with a shielding gas flow of an inert gas such as nitrogen, argon, etc. See column 3, line 60 through column 4, line 40. The use of this shielding gas prevents oxygen from entering the spray stream so that oxidation or contamination or degradation of materials is minimized. Column 4, lines 20-35. The amount of shielding fluid used is such that the oxygen level at the point of impact can be less than 1%. Column 4, lines 25-35. Nowotarski teaches that by reducing the oxygen level, the standoff distance can be increased. Column 7, lines 35-55.

Taylor article teaches that it is well known to apply ceramic coatings by plasma spraying, a form of thermal spraying. Page 2526. These ceramic coatings can include thermal barrier coatings. Page 2526. The thermal barrier coatings can be a multilayer coatings with a metallic bond coat followed by a ceramic top coat. Page 2527. The ceramic top coat is can be based on zirconium oxide (zirconia). Page 2527. The metallic bond coat can also be applied by plasma spraying. Page 2527 (the M Cr Al coat). Taylor article further teaches that it is well known to apply these thermal spray coatings to

complex shapes such as turbine vanes. See page 2530, first column. Taylor article also teaches that it is beneficial to apply the M Cr Al coat by shrouded plasma spraying. Pages 2526-2527. Furthermore, Taylor article teaches that the oxide ceramic thermal barrier overcoat can also desirably be applied by the same shrouded plasma spray system, allowing the two layer system to be applied in the same setup using the same torch by simply switching from one powder dispenser to another. Page 2527, first column. The shrouding gas can be argon. Page 2526.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Zurecki to increase the standoff distance for the same microstructure as suggested by Nowotarski and Taylor article in order to provide a desirable coating, because Zurecki teaches that the use of the coaxial shielding gas provides a decreased oxygen level in the spray stream for a given distance, thus reducing oxidation of the applied coating (that is, providing a desired microstructure of limited further oxidation) and Nowotarski teaches that the use of shielding gas that provides a decreased oxygen level in the spray stream for a given distance can allow an increased standoff distance, and that the shielding gas can be used to reduce oxidation, contamination or degradation of the material (again providing a desired microstructure) and Taylor article further teaches that it is desirable to use a shrouding (shielding) gas when thermal spraying materials such as oxide thermal barrier coatings to provide more efficient spraying. This provides a longer standoff distance to get the same microstructure as without shielding, because the resulting microstructure

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provided by the presence of a first amount of oxygen will not occur until a longer standoff distance when shielding is used since that first amount of oxygen will be present in the stream a much greater distance (more than 50 % as shown by Zurecki) from the nozzle. It would further have been obvious to modify Zurecki to perform the spraying with ceramic oxides, which would be materials not sensitive to oxidation or nitridation and to apply a zirconia coating and to apply a multilayer coating such as a thermal barrier coating of metallic bond coat followed by ceramic top coat and to apply the coating to a complex shape such as a turbine vane/blade as suggested by Nowotarski and Taylor article with an expectation of desirable coating results, because Nowotarski teaches the desire to shield coatings of ceramics and oxides as well as metals, as the shield also prevents contamination and Taylor article teaches that when thermal spraying a desirable coating system to apply is metal bond coats followed by zirconia top coats to a complex shaped substrate such as a turbine vane/blade using a shrouded plasma spraying system. It would further have been obvious to modify Zurecki to perform the shielding with argon as taught by Nowotarski and Taylor article with an expectation of desirable coating results, because Zurecki teaches the desire to shield with an inert gas, such as nitrogen, and Nowotarski teaches the desire to shield coating sprays with inert gases, which can include argon as well as nitrogen and Taylor article further teaches the use of argon as a shielding gas when plasma spraying oxides. As to the specific gas temperature results of using the shroud, it is the Examiner's position that such temperature results would naturally occur with the use of the process

of Zurecki in view of Nowotarski and Taylor article as described above, because it is the suggested use of the shroud that provides these gas temperature results, and the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

### *Response to Arguments*

6. Applicant's arguments filed June 2, 2006 have been fully considered but they are not persuasive.

Applicant argues that as to both rejections (Zurecki in view of Nowotarski and the admitted state of the prior art and Zurecki in view of Nowotarski and Taylor article), that gas shields known in the art are used to prevent or reduce oxidation of reactive materials such as metals during deposition, and it would be thought nonsensical to use such a shield when spraying a material not sensitive to oxidation or nitridation as claimed, and applicant has discovered additional benefits when using such as shield, that there are temperature benefits as now claimed. Applicant also argues that there are surprising benefits to using the gas shield when thermally spraying material not sensitive to oxidation or nitridation with the gas shield, as standoff can be extended and beneficial coatings result, with these effects thought to be due to the increased and extended temperature effect due to the shield on the thermal

spray effluent. Applicant argues that nowhere to the cited references disclose or suggest the use of the shrouding gas in thermal spraying a material not sensitive to oxidation or nitridation, or that the standoff distance can be lengthened without degradation of the microstructure or other properties of the coating, or that the temperature effect as claimed is provided.

The Examiner has reviewed these arguments, however, the rejections are maintained. The cited references clearly suggest the spraying of materials that are not sensitive to oxidation or nitridation using a gas shield as claimed. Nowotarski specifically teaches that the coating material can be "plastics", "oxides", "ceramics" and "certain glasses" (column 3, lines 55-60). Many materials in this grouping are well known to commonly be insensitive to oxidation or nitridation, and Nowotarski provides no limitation as to which of these materials can be used. Moreover, Nowotarski also provides that the gas shroud not only minimizes oxidation but also "contamination" and "degradation" of materials (column 4, lines 20-30). Moreover, as to the second rejection, Taylor article further provides the explicit teaching of spraying thermal barrier oxide coatings using the shrouded gas system (page 2527, first column). Thus, the rejection provided by the Examiner clearly suggests that it is known and desired to use a gas shield when spraying oxides, etc., which materials would not be sensitive to oxidation or nitridation. As to the standoff distance being desirably increased, the Examiner has cited the references to Zurecki and Nowotarski as showing the benefits of increased standoff distance using the gas shield. As to the temperature

effects, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). This temperature effect would result from using the gas shield as already suggested to do so by the prior art, as shown by the rejections above.

### *Conclusion*

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katherine A. Bareford whose telephone number is (571)


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272-1413. The examiner can normally be reached on M-F(6:00-3:30) with the First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone numbers for the organization where this application or proceeding is assigned are (571) 273-8300 for regular communications and for After Final communications.

Other inquiries can be directed to the Tech Center 1700 telephone number at (571) 272-1700.

Furthermore, information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
KATHERINE BAREFORD  
PRIMARY EXAMINER